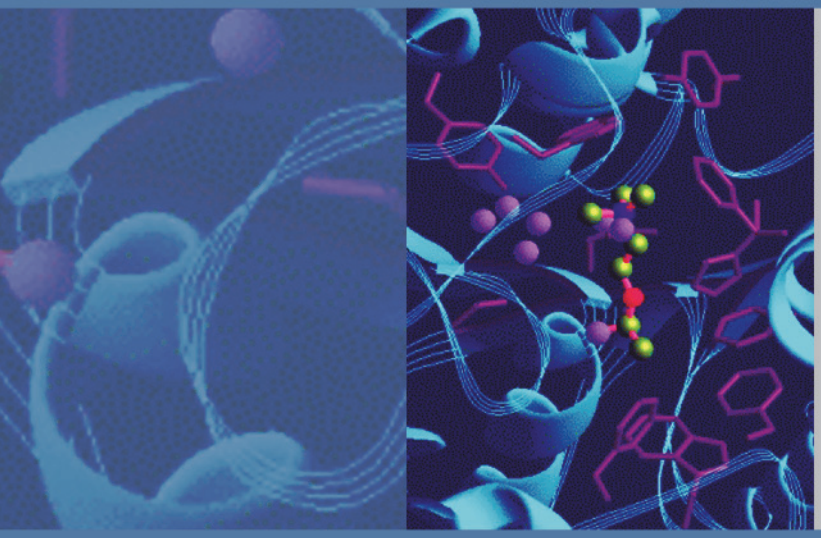

Thermo

EASY-Spray Ion Source

User Guide

60053-97260 Revision A May 2012

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Thermo Fisher Scientific performs complete testing and evaluation of its products to ensure full compliance with applicable domestic and international regulations. When the system is delivered to you, it meets all pertinent electromagnetic compatibility (EMC) and safety standards as described in the next section or sections by product name.

Changes that you make to your system may void compliance with one or more of these EMC and safety standards. Changes to your system include replacing a part or adding components, options, or peripherals not specifically authorized and qualified by Thermo Fisher Scientific. To ensure continued compliance with EMC and safety standards, replacement parts and additional components, options, and peripherals must be ordered from Thermo Fisher Scientific or one of its authorized representatives.

EMC Directive 2004/108/EC

EMC compliance has been evaluated by Intertek Semko AB.

EN61326-1:2006

Low Voltage Safety Compliance

This device complies with Low Voltage Directive 2006/95/EC and harmonized standard EN 61010-1:2001.

FCC Compliance Statement

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

CAUTION Read and understand the various precautionary notes, signs, and symbols contained inside this manual pertaining to the safe use and operation of this product before using the device.

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Preface

The *EASY-Spray Ion Source User Guide* describes the hardware components, and provides installation and configuration procedures for the Thermo Scientific™ EASY-Spray™ ion source.

Use the EASY-Spray ion source with the following Thermo Scientific mass spectrometers (MSs) for nanoelectrospray (commonly referred to as "nanoES" or "nanospray") analysis:

- Exactive™, Q Exactive™
- Orbitrap™ Series
- LTQ™ Series
- TSQ Series
- LCQ™ Deca XP Max

For information about your specific mass spectrometer, refer to the user documentation provided with your instrument.

Contents

- Product Requirements
- Contents of the EASY-Spray Ion Source Kit
- Safety and Special Notices
- Contacting Us

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Product Requirements

Table 1 lists the environmental requirements for the EASY-Spray source. The requirements for the mass spectrometer supersede these requirements. Refer to the "Operating Environment" chapter in the preinstallation requirements guide for your Thermo Scientific mass spectrometer.

CAUTION The EASY-Spray source must connect to a certified Thermo Scientific mass spectrometer, which supplies high voltage capable of delivering a maximum of 8 kV and 100 µA.

If you connect the EASY-Spray source to another type of mass spectrometer, you might impair the protection provided by the equipment.

Table 1. EASY-Spray source environmental requirements

Parameter	Specification
Altitude	Up to 2000 m (6562 ft)
Humidity	Maximum relative humidity 80% for temperatures up to 31 °C (88 °F), decreasing linearly to 50% relative humidity at 40 °C (104 °F)
Operating environment	Pollution degree 2 (indoor environment; normally only nonconductive pollution)
Temperature	Ambient temperature: 15–27 °C (59–81 °F)

Contents of the EASY-Spray Ion Source Kit

Table 2 lists the parts supplied in the EASY-Spray Ion Source Kit (P/N ES081). For a list of replaceable parts, see Chapter 8, "Replaceable Parts."

Table 2. EASY-Spray Ion Source Kit (P/N ES081) (Sheet 1 of 2)

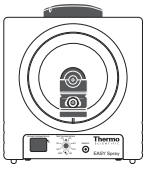
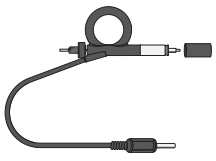
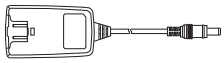
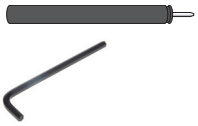
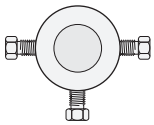
Image	Description	Quantity	Part number
	EASY-Spray source housing	1	—[a]
	EASY-Spray column, 15 cm × 3 µm ID	1	ES800

Table 2. EASY-Spray Ion Source Kit (P/N ES081) (Sheet 2 of 2)

Image	Description	Quantity	Part number
	Controller power supply assembly: • Power supply unit, 24 Vdc output (shown without the input plug) • Power adapter cable (not shown)	1	ES231
	Dino-Lite™ digital video camera and power supply unit (not shown)	1	ES216
	Monitor, power supply unit, and BNC adapter (not shown)	1	ES217
	Tools: • Emitter positioning tool • 3 mm hex key	1 set	ES232
	1.5 mm hex key	1	—
	A/B mixing/venting tee, stainless steel, with three attached ferrules and nuts	1 set	SC901
	Sleeves, PEEK™, 1/16 in. OD	3	IDEX™, F-233

[a] To order another EASY-Spray source housing, you must order the EASY-Spray Ion Source Kit (P/N ES081)

Safety and Special Notices

Make sure you follow the precautionary statements presented in this guide. The safety and other special notices appear in boxes. Safety and special notices include the following.

CAUTION Highlights hazards to humans, property, or the environment. Each CAUTION notice is accompanied by an appropriate CAUTION symbol.

IMPORTANT Highlights information necessary to prevent damage to software, loss of data, or invalid test results; or might contain information that is critical for optimal performance of the system.

Note Highlights information of general interest.

Tip Highlights helpful information that can make a task easier.

Table 3 lists additional caution-specific symbols that appear in the *EASY-Spray Ion Source User Guide*.

Table 3. Caution-specific symbols and their meanings

Symbol	Meaning
	Chemical: Hazardous chemicals might be present in the instrument. Wear gloves when handling carcinogenic, corrosive, irritant, mutagenic, or toxic chemicals. Use only approved containers and procedures for disposing of waste oil.
	Electric Shock: An electric shock hazard is present in the instrument. Proceed with caution.
	Hot Surface: Allow heated components to cool before touching or servicing the instrument.
	Trip Hazard: The power supply cords might present a trip hazard. Be aware of the cords' locations and secure them in place as needed.

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❖ To order consumable and spare parts

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❖ To contact Technical Support

Phone	800-532-4752
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–or–

Use the list on the following pages.

Note The country code is enclosed in square brackets [ ]. The city code or area code is enclosed in parenthesis ( ).

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Fax ..... [86] 108 837 0548

Introduction

The Thermo Scientific EASY-Spray ion source, shown in Figure 1, maintains excellent spray stability to ensure efficient evaporation and ionization of the liquid samples—the key to achieving the highest sensitivity at nano-flow rates.

Key benefits of the EASY-Spray source are as follows:

- Simple, reliable, and robust design
- Effortless nano liquid chromatography (nanoLC)/MS integration
- Better separation with zero dead volume (ZDV) connections
- Increased productivity with the temperature-controlled EASY-Spray column™

Figure 1. nanoLC/MS system using the EASY-Spray ion source, camera, and monitor

Contents

- Advantages of Nanoelectrospray
- Functional Description

Advantages of Nanoelectrospray

The use of electrospray ionization (ESI) has evolved as a leading technique for generating intact, gas-phase ions from thermally labile, polar analytes in solution. In this technique, ionization is induced by the use of an emitter (a capillary tube or needle) at a controlled distance from a counter electrode. Direct current (dc) voltage is applied, either to the needle or to the solvent, to produce a strong electrical field at the emitter tip. The electric field excites the ions in the solution as they leave the emitter tip. This interaction results in electrohydrodynamic disintegration of the fluid, generation of droplets, and formation of an aerosol jet.

Conventional ESI employs flow rates from 1 µL/min to 1 mL/min. Due to the high volume of liquid exiting the emitter, a drying gas, thermal heating, or both are often required to expedite desolvation and droplet shrinkage. A form of ESI that employs low flow rates of 10–1000 nL/min is nanoelectrospray ionization (nanoESI or NSI), which is also known as nanospray ionization (NSI). NSI (or nanoESI) generally does not require a drying gas or thermal heating. Compared with ESI, NSI tolerates a wider range of liquid compositions including pure water.

As you lower the flow rate, a lower volume of mobile phase passes through the emitter, producing smaller aerosol droplets. This makes NSI more effective than conventional ESI at concentrating the analyte at the emitter tip, producing significant increases in sensitivity demonstrated by the signal response of the mass spectrometer.

Note The Thermo Tune Plus application uses the terms “nanospray” and “NSI.”

Functional Description

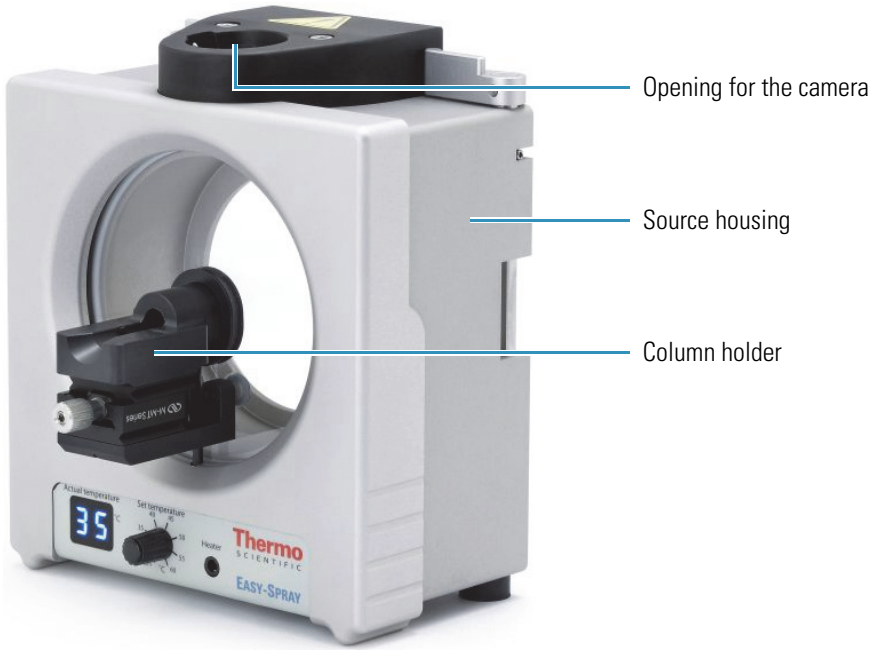
This section describes the following principal components of the EASY-Spray source and their functions:

- Source Housing
- Controller PCB
- Controller Power Supply

Source Housing

The EASY-Spray source housing (Figure 2) arrives assembled and is easy to install on the mass spectrometer. The source housing includes two locking levers, two observation windows, a position-adjustable column holder, and a controller printed circuit board (PCB). For installation instructions, see "Installing the Ion Source onto the Mass Spectrometer" on page 8.

Figure 2. EASY-Spray source housing



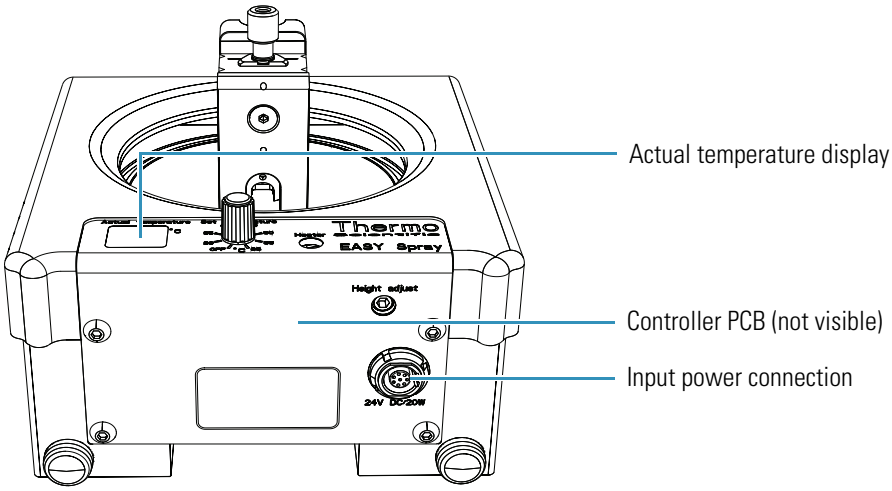
Using the top and front observation windows, you can view the tip of the emitter positioning tool while you move it into position. To enhance your view of the tool and then later of the emitter, connect the digital video camera and LCD monitor. For instructions, see Chapter 3, "Connecting the LCD Monitor and Video Camera."

The column holder is mounted onto the front observation window and includes a position control knob. Use the control knob to align the *z* axis (front-to-back) of the emitter positioning tool (Figure 9 on page 11) with the mass spectrometer's ion transfer tube. To align the tool's *x*-axis (side-to-side) and *y*-axis position (up-and-down), use the controls that are built into the EASY-Spray source housing. For instructions, see "Adjusting the Emitter Tip Position" on page 11.

Controller PCB

The EASY-Spray source contains a controller PCB (Figure 3) that powers and controls the heat generated for the connected EASY-Spray column. The controller PCB includes an input power socket, an output heater socket, a temperature control dial, and an actual temperature display.

Figure 3. Controller PCB located on the bottom of the EASY-Spray source



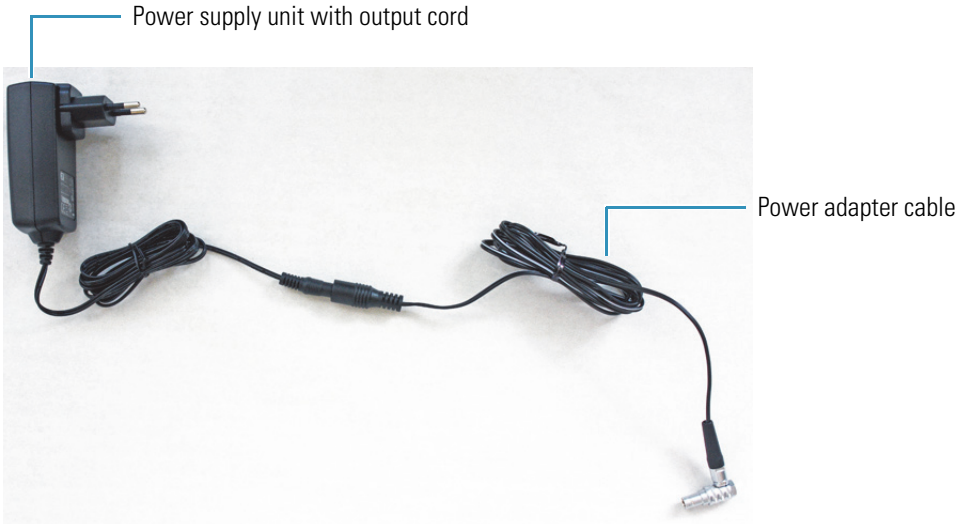
The controller power supply unit connects to the input power socket, which is located on the bottom, right side of the EASY-Spray source. The cable from the EASY-Spray column connects to the heater socket, which is located on the front and labeled “Heater.”

The temperature control dial has an OFF setting and temperature settings in 5 °C increments for the 30–60 °C range. As the column heats up, the actual temperature appears on the display.

Controller Power Supply

Figure 4 shows the controller power supply assembly that consists of a wall-mounted power supply unit with a detachable input plug and a power adapter cable. The other end of the power adapter cable connects to the input power socket located on the bottom of the EASY-Spray source (Figure 3 on page 4 and Figure 8 on page 10) to provide the 24 Vdc input for the controller PCB.

Figure 4. Controller power supply assembly (shown with a European input plug)



The total length of the output cord and power adapter cable is approximately 9 ft (274 cm). Make sure that there is an electrical wall outlet within reach for the power supply unit and that you provide suitable clearance around it for cooling.

Installing the EASY-Spray Source

Follow these procedures to install or remove the EASY-Spray source. The only tool required is the 3 mm hex key.

Note The complete EASY-Spray source installation, including the digital camera and LCD monitor, requires three electrical wall outlets. Ensure that your lab has the appropriate outlets near the nanoLC/MS system.

Contents

- Installing the Ion Source onto the Mass Spectrometer
- Connecting the Controller Power Supply
- Adjusting the Emitter Tip Position
- Removing the EASY-Spray Source

Installing the Ion Source onto the Mass Spectrometer

Before you install the EASY-Spray source, follow the procedure to prepare the mass spectrometer.

❖ To prepare the mass spectrometer

1. If installed, remove any other source from the mass spectrometer after it has cooled to room temperature.

   For instructions, refer to the mass spectrometer's documentation.

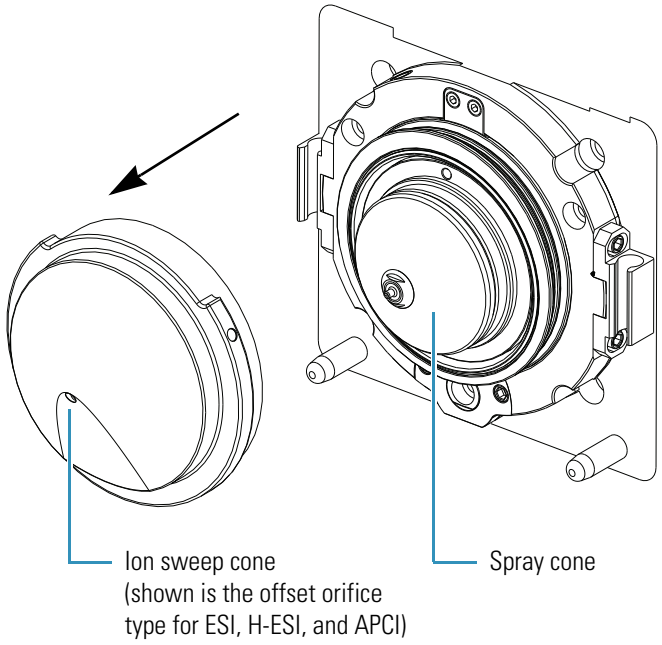
CAUTION HOT SURFACE Accidental contact with the part of the API probe located inside the housing can severely burn you, as this area of the probe can reach 350 °C (662 °F). In addition, although the exterior surface of the housing and the exposed part of the probe fall below the limit of 70 °C (158 °F) for accessible metal surfaces, they too pose a burn hazard. Therefore, handle ALL parts of the probe and housing with extreme caution.

- Before removing the API probe and housing, allow the part to cool to room temperature (approximately 20 minutes) before you touch it.
- If the mass spectrometer connects to an LC system, leave the solvent flow from the LC pump on while the probe cools to room temperature.

2. If installed, remove the optional ion sweep cone (Figure 5) from the mass spectrometer by grasping the outer ridges of the ion sweep cone and pulling it off.

   The spray cone is directly behind the ion sweep cone.

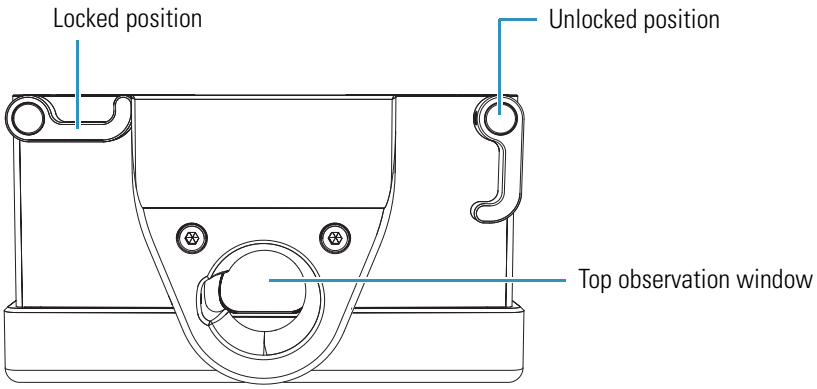
Figure 5. Ion sweep cone removed from the mass spectrometer's spray cone



❖ To install the EASY-Spray source onto the mass spectrometer

1. Follow the procedure "To prepare the mass spectrometer" on page 8.
2. Rotate the locking levers toward the front of the source to the unlocked position (right lever in Figure 6).

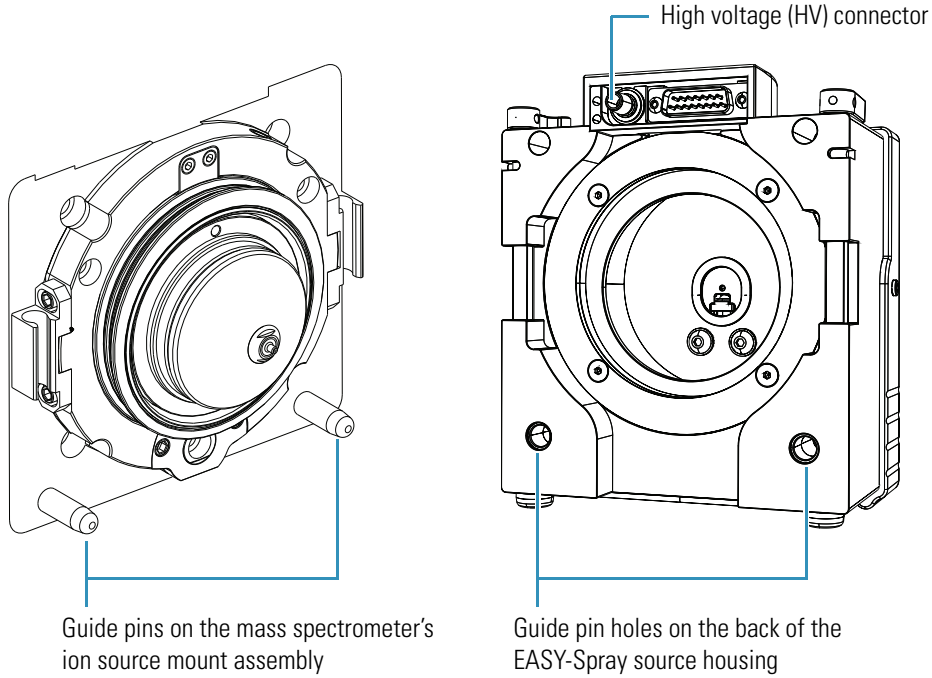
Figure 6. Locking lever positions



3. Align the two guide pin holes on the back of the source with the guide pins on the mass spectrometer's ion source mount assembly (Figure 7).

Note Your mass spectrometer might have a slightly different mount assembly, ion sweep cone, or both.

Figure 7. Ion source housing connection


High voltage (HV) connector
Guide pins on the mass spectrometer's ion source mount assembly
Guide pin holes on the back of the EASY-Spray source housing

4. Carefully press the source onto the mass spectrometer.
5. Rotate the locking levers 90 degrees toward the top window to the locked position (left lever in Figure 6 on page 9).

   The locked levers are now parallel with the front of the mass spectrometer.

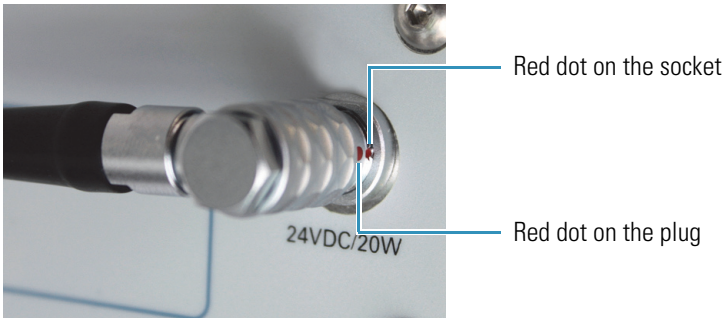
Connecting the Controller Power Supply

CAUTION To avoid an electric shock, always use the detachable input plug provided with the power supply unit that is suitable for your country or region.

❖ **To connect the controller power supply unit**

1. Turn the temperature dial on the EASY-Spray source to the OFF position.
2. If not already connected, connect the detachable input plug and power adapter cable to the power supply unit (Figure 4 on page 5).
3. Plug the power supply unit into an electrical wall outlet.
4. Connect the power adapter cable to the input power socket located on the bottom, right side of the source (Figure 12 on page 13) as follows:
   a. Align the red dot on the plug with the red dot on the socket, which is on the right side of the socket (Figure 8).

      Figure 8. Power connection for the controller PCB

   b. Push the plug upward into the socket.

CAUTION After completing the power supply connections, route the output cord so that it is not a trip hazard.

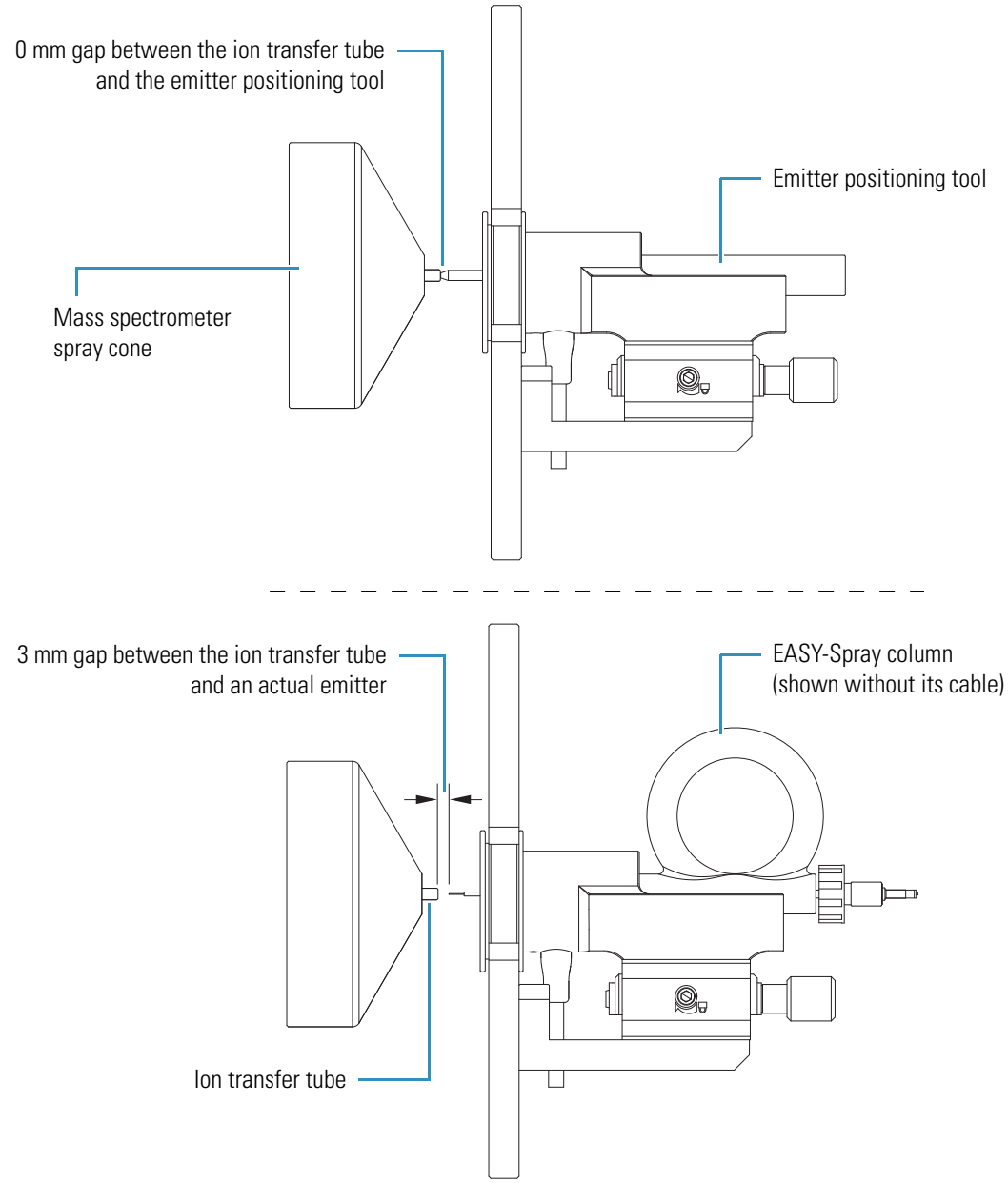
Adjusting the Emitter Tip Position

Before installing the EASY-Spray column, use the emitter positioning tool (Figure 9) and 3 mm hex key to adjust the position of the column holder.

Figure 10 shows the emitter positioning tool touching the mass spectrometer's ion transfer tube, which then correctly provides a 3 mm gap for the EASY-Spray column's emitter.

Figure 9. Emitter positioning tool

Figure 10. Gap positions in front of the mass spectrometer's ion transfer tube

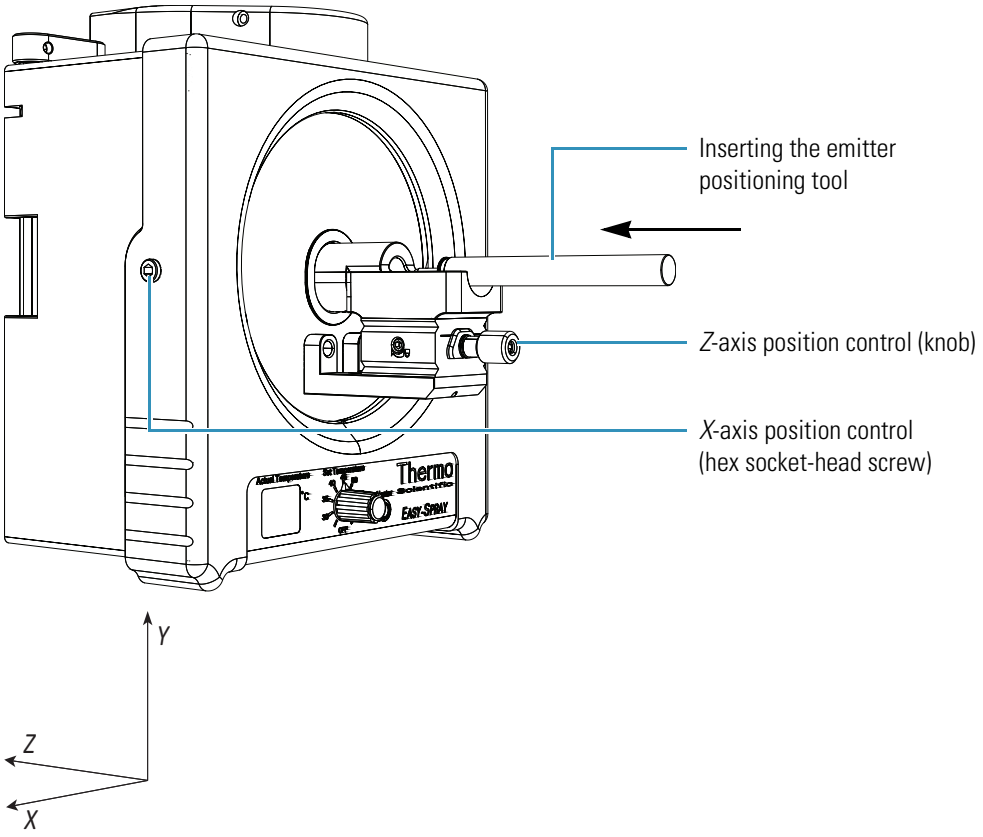

0 mm gap between the ion transfer tube and the emitter positioning tool
Emitter positioning tool
Mass spectrometer spray cone
3 mm gap between the ion transfer tube and an actual emitter
EASY-Spray column (shown without its cable)
Ion transfer tube

❖ To adjust the emitter tip position

Tip To enhance your view of the emitter positioning tool's tip, install the video camera and monitor before you begin this procedure. For instructions, see Chapter 3, "Connecting the LCD Monitor and Video Camera."

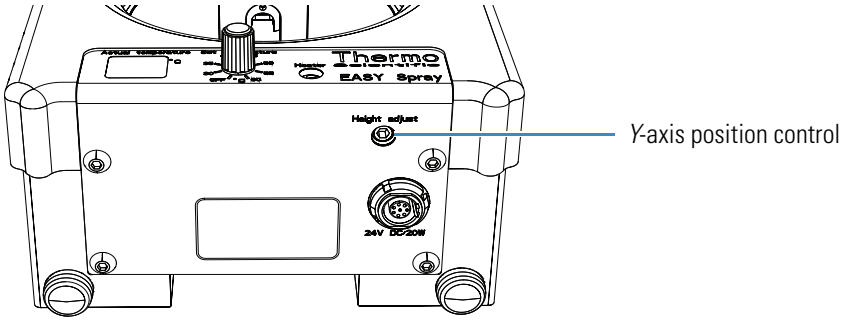
1. Retract the *z*-axis (front-to-back) position by turning the control knob located on the column holder counterclockwise (Figure 11).
2. Insert the emitter positioning tool into the top of the column holder, and then slowly slide it forward until it clicks into place.
3. Align the *x*-axis (side-to-side) position of the emitter positioning tool to the bore of the ion transfer tube by inserting the hex key into the left-side hex socket-head screw (Figure 11).

Figure 11. *X*- and *z*-axes position controls on the EASY-Spray source



4. Align the *y*-axis (up-and-down) position of the emitter positioning tool to the bore of the ion transfer tube by inserting the hex key into the bottom hex socket-head screw (Figure 12).

Figure 12. *Y*-axis position control on the EASY-Spray source



5. Adjust the *z*-axis (front-to-back) position of the emitter positioning tool's tip by turning the control knob located on the front of the column holder (Figure 11 on page 12). Move the tool's tip so that it gently touches the bore of the ion transfer tube.

IMPORTANT The fused-silica emitter is fragile. Make sure that the emitter positioning tool gently touches the ion transfer tube when you adjust its position or you will damage the actual emitter when fully inserted, requiring you to replace the EASY-Spray column.

6. After you adjust the tool tip's position, slowly remove the emitter positioning tool.

The position of the column holder is now calibrated for use with any EASY-Spray column. You must repeat this procedure if you later change the *x*-, *y*-, or *z*-axis position.

Removing the EASY-Spray Source

Follow this procedure if you need to remove the EASY-Spray source from the mass spectrometer.

❖ **To remove the source from the mass spectrometer**

1. In the Tune Plus application, place the mass spectrometer in **Standby** mode.

   For instructions, refer to the mass spectrometer's documentation.

2. Turn the source's temperature dial to the OFF position.

CAUTION HOT SURFACE Although below the maximum safety limit of 70 °C (158 °F), the EASY-Spray source can reach approximately 50 °C (122 °F) with the heater unit turned on, which can severely burn you. Allow the source to cool to room temperature (approximately 20 minutes) before you touch it.

3. Turn off the LC instrument.
4. Disconnect the LC plumbing from the EASY-Spray column, and then remove the EASY-Spray column.

   Note Do not pull on the cable from the EASY-Spray column. Use the plug to disconnect the column from the heater socket.

5. Remove the camera as follows:
   a. Unplug the camera power supply unit from the electrical wall outlet.
   b. Disconnect the camera's yellow video connector from the back of the monitor and the black power connector from the camera power supply unit.
   c. Using the 1.5 mm hex key, loosen the hex socket-head screw securing the camera, and then remove the camera.
6. Unplug the controller power supply unit from the electrical wall outlet, and then disconnect the output cable from the source.
7. Rotate the locking levers 90 degrees toward the front of the source to the unlocked position (Figure 6 on page 9).
8. Grasp the source housing with both hands and slowly pull away from the mass spectrometer until it clears the guide pins.

After you remove the EASY-Spray source from the mass spectrometer, place it in its original shipping box. The EASY-Spray source does not require cleaning.

Connecting the LCD Monitor and Video Camera

Follow these procedures to connect the LCD monitor and digital video camera, and to adjust the video picture. The only tool required is the 1.5 mm hex key.

Contents

- Connecting the Monitor and Camera
- Adjusting the Video Picture

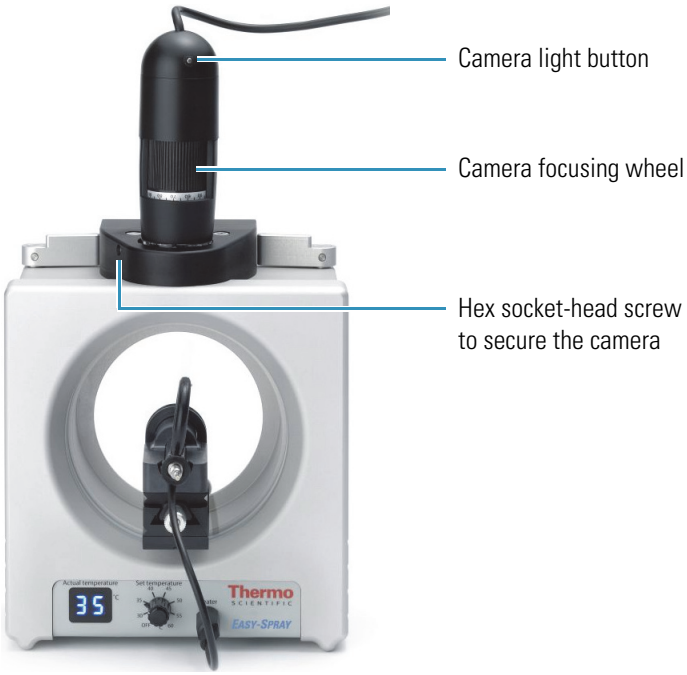
Connecting the Monitor and Camera

To enhance your view of the emitter tip, install the LCD monitor and digital video camera that are provided in the EASY-Spray Ion Source Kit (see Table 2 on page xii).

❖ **To connect the monitor and camera**

1. Follow the procedure "To install the EASY-Spray source onto the mass spectrometer" on page 9.
2. Plug the two power supply units into electrical wall outlets.
3. Install the camera as follows:
   a. Insert the camera into the opening above the top observation window with the focusing wheel facing toward you (Figure 13).
   b. Using the 1.5 mm hex key, tighten the hex socket-head screw on the left side of the top observation window (Figure 11 on page 12) until it touches the camera—do not overtighten the screw.
   c. Connect the camera's black power connector to its power supply unit.

Figure 13. Camera and column installed on the EASY-Spray source



4. On the back of the monitor, make the following connections:
   - BNC adaptor to one of the Video IN ports
   - Camera's yellow video connector to the BNC adaptor
   - Output cord from the other power supply unit to the DC 12V IN socket

CAUTION After completing the power supply connections, route the output cords so that they are not a trip hazard.

5. Place the monitor on top of the mass spectrometer near the source by using its support arm.

   Make sure that the monitor is not too close to the edge.

Adjusting the Video Picture

Use this procedure to focus the picture from the video camera. For additional information, refer to the manuals that came with the monitor and camera.

❖ To adjust the video picture

1. Follow the procedure "To connect the monitor and camera" on page 15.
2. Turn on the monitor by pressing its POWER button.

   The picture appears after a few seconds and is probably blurred. If there is no picture, press the monitor's SOURCE button to change to the other video input channel.
3. If the picture is too dark, turn on the camera light by pressing its top light button (Figure 13 on page 16).
4. Adjust the picture by using the camera's focusing wheel (Figure 13 on page 16).

Connecting the LC to the EASY-Spray Column

Follow these procedures to connect the plumbing from the Thermo Scientific LC instrument to the EASY-Spray column.

Contents

- Tools and Supplies
- Installing the EASY-Spray Column for the First Time
- Using the nanoViper Fitting
- Connecting the LC to the EASY-Spray Column

Tools and Supplies

Table 4 lists the required tools and supplies for connecting the LC plumbing configurations to the EASY-Spray column. Not all parts are required for each configuration.

Note The EASY-Spray Ion Source Kit (P/N ES081) supplies the venting tee, fittings, and sleeves. You are responsible for supplying the remaining parts and tools.

Table 4. Tools and supplies (Sheet 1 of 2)

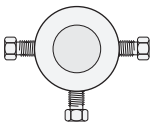
Image	Description	Part number
One- and two-column setups		
	A/B mixing/venting tee, stainless steel, with three attached ferrules and nuts	SC901
	Sleeves, PEEK™, 1/16 in. OD	IDEX™, F-233
	Wrench, open end, 1/4 in.	—

Table 4. Tools and supplies (Sheet 2 of 2)

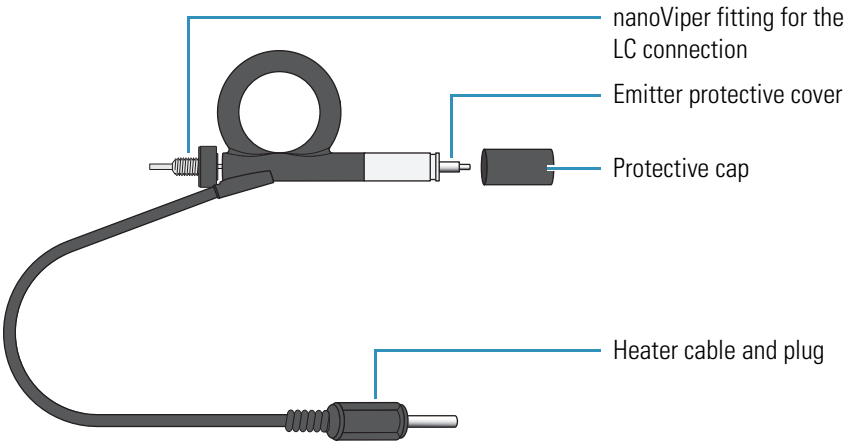
Image	Description	Part number
—	Gloves, lint-free and powder-free	Fisher Scientific: • 19-120-2947A (small) • 19-120-2947B (medium) • 19-120-2947C (large) • 19-120-2947D (X-large) Thermo Scientific: • 23827-0008 (medium) • 23827-0009 (large)
Two-column setup		
	Any nanoViper-equipped precolumn This image shows the Acclaim™ PepMap100 Nano-Trap.	(For the PepMap100 Nano-Trap) Fisher Scientific, 164705
	Viper™ union (for use with the EASY-nLC 1000)	Thermo Scientific Dionex™, 6040.2304
	ZDV adapter union (1/16 to 1/32 in.) and plug (not shown) (for use with the EASY-nLC II)	IDEX, P-881
—	UltiMate™ 3000 RSLCnano EASY-Spray Application Kit	Thermo Scientific Dionex, 6720.0395

Installing the EASY-Spray Column for the First Time

The EASY-Spray column (Figure 14) contains an integrated heatable column and a fused-silica emitter. For available columns, see Chapter 8, "Replaceable Parts."

IMPORTANT The EASY-Spray column assembly includes an emitter protective cover. If you push back this cover by hand, you could damage the fused-silica emitter and make the EASY-Spray column unusable.

Figure 14. EASY-Spray column



❖ To install the EASY-Spray column

1. Follow the procedure "To adjust the emitter tip position" on page 12.

   Note You can skip this step after the first time if you have not adjusted the column holder's position.

2. Remove the protective cap on the end of the EASY-Spray column (Figure 14).
3. With the cable on the bottom, slowly push the tip of the EASY-Spray column into the column holder opening until it clicks into place.

   As the EASY-Spray column moves forward into the source, the protective cover over the emitter retracts to expose the emitter tip.

4. Connect the cable to the front output heater socket.

   Note Do not pull on the cable from the EASY-Spray column. Use the plug to connect and disconnect the column.

5. Follow the appropriate procedure in "Connecting the LC to the EASY-Spray Column" on page 23.
6. Using the temperature control dial, set the temperature for the EASY-Spray column.

   Table 5 lists the display readings that can appear on the actual temperature display.

Table 5. Readings for the actual temperature display

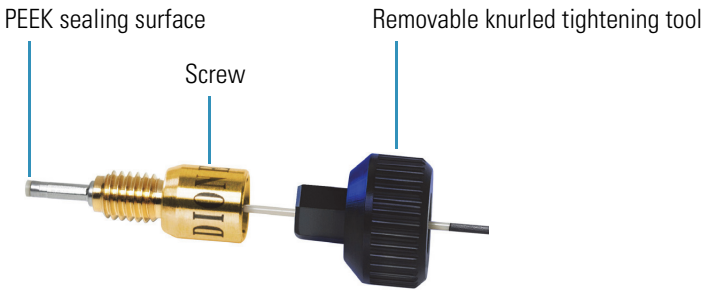
Display	Description
--	EASY-Spray column is not connected.
xx.	Actual temperature while heating up
xx	Actual temperature, stabilized
BL	Disconnect and reconnect power to the source.[a]

[a] If the display does not change, you must replace the controller PCB. See "Replacing the Controller PCB" on page 36.

Using the nanoViper Fitting

For some of the LC instruments, the plumbing connects to the EASY-Spray column through several nanoViper fittings, such as the one shown in Figure 15. Although these fittings can withstand ultra-high-performance LC (UHPLC) backpressures up to ~1034 bar (~15 000 psi), they are fingertight fittings, which require only very small torques to seal. Therefore, you must follow the procedure below to avoid damage by overtightening.

Figure 15. nanoViper fitting



❖ To use a nanoViper fitting

1. Insert the nanoViper fitting into the target port and slowly rotate the screw clockwise until you feel resistance.
2. Using the black knurled fitting tool, tighten the screw clockwise to an angle of 0–45 degrees (1/8-turn).
3. Start operating the system at the desired working pressure and check the backpressure.

4. If the backpressure is too low, check the system for leaks.

   For instructions, refer to the documentation for the LC instrument.

5. If the backpressure continues to be too low, return the system to atmospheric pressure.

   IMPORTANT To extend the lifetime of the nanoViper fittings, open and close the connections at only atmospheric system pressures. Opening and closing connections at high system pressures can reduce the lifetime of the fittings.

6. Tighten the screw by as much as an additional 45 degrees. Do not turn the screw beyond an angle of 90 degrees from where you felt the initial resistance.

   IMPORTANT To prevent damage to the sealing surface of the nanoViper fitting, do not overtighten the fitting.

Connecting the LC to the EASY-Spray Column

This section describes how to connect the one or two plumbing lines from a nanoLC instrument to the EASY-Spray column in either a one- or two-column configuration. Table 4 on page 19 lists the required parts.

Note The EASY-nLC series instruments identify the two solvent lines as “Column Out” and “Waste In.”

CAUTION Wear protective gloves when handling the solvent lines.

Follow one of these procedures:

- Connecting an EASY-nLC 1000 Instrument to the EASY-Spray Column
- Connecting an EASY-nLC II Instrument to the EASY-Spray Column on page 26
- Connecting an RSLCnano System to the EASY-Spray Column on page 28

Connecting an EASY-nLC 1000 Instrument to the EASY-Spray Column

Follow the appropriate procedure for a one- or two-column setup. The two-column setup includes a precolumn connected in the column-out flow path to the venting tee.

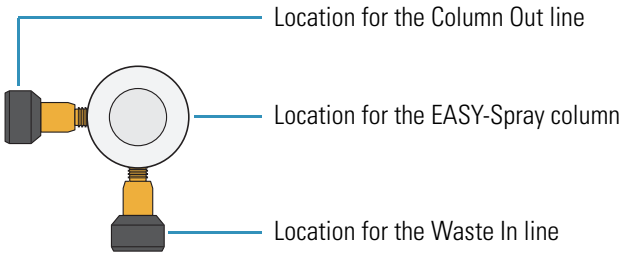
Note Remove the nuts and ferrules from the venting tee.

- To plumb a one-column setup from an EASY-nLC 1000 instrument
- To plumb a two-column setup from an EASY-nLC 1000 instrument (on page 25)

❖ To plumb a one-column setup from an EASY-nLC 1000 instrument

1. On the Column Out line, insert the nanoViper fitting into the venting tee's side port as shown in Figure 16, tighten the fitting by hand until you feel resistance, and then tighten the fitting again by an additional 1/8- to 1/4-turn. Do not tighten the fitting by more than a 1/4-turn.

Figure 16. Recommended plumbing locations on the venting tee (nanoViper example)



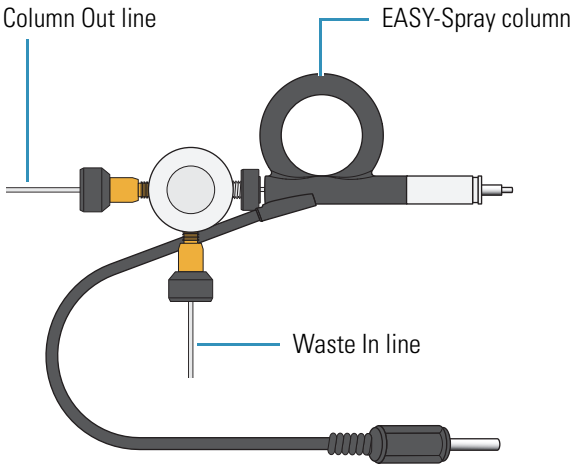
CAUTION Because the fittings seal against each other inside the union, do not tighten them by more than 1/4-turn (90 degrees). Overtightening the fittings can irreparably damage their sealing surfaces.

For additional information about nanoViper fittings, see "Using the nanoViper Fitting" on page 22.

2. On the Waste In line, insert the fitting into the venting tee's bottom port, tighten the fitting by hand until you feel resistance, and then tighten the fitting by an additional 1/8- to 1/4-turn. Do not tighten the fitting by more than a 1/4-turn.

3. Connect the venting tee to the EASY-Spray column to complete the one-column setup (Figure 17).

Figure 17. Example of a one-column setup with nanoViper fittings



❖ To plumb a two-column setup from an EASY-nLC 1000 instrument

1. Assemble and connect the Column Out line as follows:
   a. Insert the nanoViper fitting on the Column Out line into the Viper union, tighten the fitting by hand until you feel resistance, and then tighten the fitting again by an additional 1/8- to 1/4-turn (45–90 degrees). Do not tighten the fitting by more than a 1/4-turn.

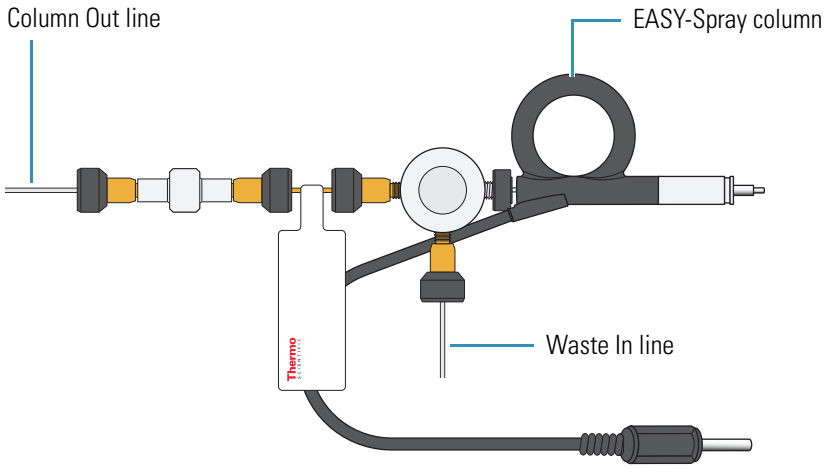
   Note See the caution statement on page 24.

   b. Connect the other end of the union to the appropriate end of the nanoViper precolumn.

   Note Follow the recommended flow direction stated on the precolumn label.

   c. Insert the fitting on the other end of the precolumn into the venting tee's side port (Figure 16 on page 24), and then tighten as noted in step 1a.
2. On the Waste In line, insert the fitting into the venting tee's bottom port, tighten the fitting by hand until you feel resistance, and then tighten the fitting again by an additional 1/8- to 1/4-turn. Do not tighten the fitting by more than a 1/4-turn.
3. Connect the venting tee to the EASY-Spray column to complete the two-column setup (Figure 18).

Figure 18. Example of a two-column setup with nanoViper fittings and a Viper union



Tip When you install the two-column assembly, clear the One Column Setup check box in the EASY-nLC device section on the Devices page of the Maintenance menu. For instructions, refer to "Setting Up the Properties for the HPLC Device" in Chapter 4 of the *EASY-nLC 1000 User Guide*.

When the One Column Setup check box is clear (not selected), valve W on the EASY-nLC 1000 moves to position 1–6 during the sample loading step. Excess solvent A exits the venting tee and passes through valve W to the waste beaker.

Connecting an EASY-nLC II Instrument to the EASY-Spray Column

Follow the appropriate procedure for a one- or two-column setup. The two-column setup includes a precolumn connected in the column-out flow path to the venting tee.

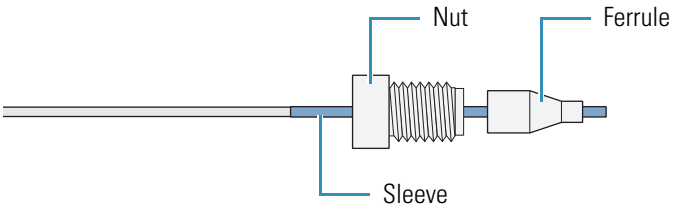
Note Remove the nuts and ferrules from the venting tee.

- To plumb a one-column setup from an EASY-nLC II instrument
- To plumb a two-column setup from an EASY-nLC II instrument

❖ To plumb a one-column setup from an EASY-nLC II instrument

1. Attach the nuts and ferrules to the Column Out and Waste In lines as follows:
   a. Insert one of the lines into a sleeve, and then slowly push it forward until the line is parallel with the end of the sleeve.
   b. Slide the nut and then the ferrule onto the sleeved line until the sleeve extends past the ferrule (Figure 19).
   c. Repeat step 1a and step 1b with the second line.

   Figure 19. LC line with sleeve, ferrule, and nut

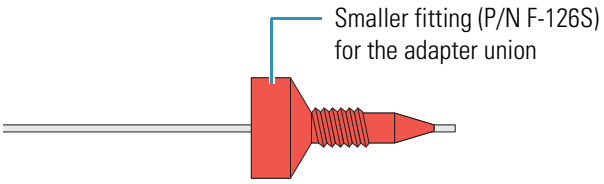
2. On the Column Out line, insert the fittings into the venting tee's side port (Figure 16 on page 24), tighten the nut by hand until you feel resistance, and then use the 1/4 in. wrench to tighten the nut until firmly secured—do not overtighten.
3. On the Waste In line, insert the fittings into the venting tee's bottom port, tighten the nut by hand until you feel resistance, and then use the 1/4 in. wrench to tighten the nut until firmly secured—do not overtighten.
4. Connect the venting tee to the EASY-Spray column to complete the one-column setup.

Figure 17 on page 24 shows an example of a one-column setup for the EASY-nLC 1000 instrument, which uses nanoViper fittings.

❖ To plumb a two-column setup from an EASY-nLC II instrument

1. Assemble and connect the Column Out line as follows:
   a. Remove the smaller fitting from the ZDV adapter union, insert the Column Out line into the fitting, and then slowly push the line forward until it extends past the fitting (Figure 20).

      Figure 20. Column Out line with smaller fitting from the ZDV adapter union

   b. With the plug inserted into the ZDV adapter union's larger end, insert the Column Out line into the union's smaller end, and then tighten the smaller fitting until you feel resistance.
   c. Remove the plug from the adapter union, and then connect the adapter union's larger end to the appropriate end of the nanoViper precolumn.

      Note Follow the recommended flow direction stated on the precolumn label.

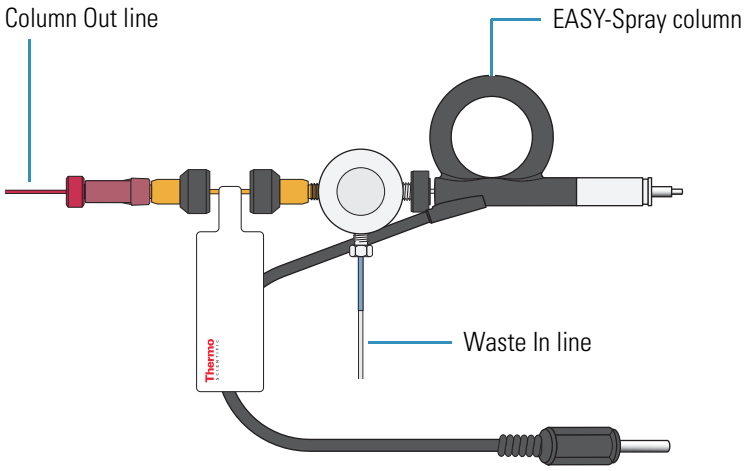
   d. Insert the fitting at the other end of the precolumn into the venting tee's side port (Figure 16 on page 24), and then tighten the fitting by an additional 1/8- to 1/4-turn (45–90 degrees). Do not tighten the fitting by more than a 1/4-turn.

CAUTION Because the fittings seal against each other inside the union, do not tighten them by more than 1/4-turn (90 degrees). Overtightening the fittings can irreparably damage their sealing surfaces.

For additional information about nanoViper fittings, see "Using the nanoViper Fitting" on page 22.

2. Assemble and connect the Waste In line as follows:
   a. Attach a nut and ferrule to the Waste In line. See step 1a and step 1b in "To plumb a one-column setup from an EASY-nLC II instrument" on page 26.
   b. Insert the nut and ferrule fittings into the venting tee's bottom port, tighten the nut by hand until you feel resistance, and then use the 1/4 in. wrench to tighten the nut until firmly secured—do not overtighten.
3. Connect the venting tee to the EASY-Spray column to complete the two-column setup (Figure 21).

Figure 21. Example of a two-column setup for the EASY-nLC II



Connecting an RSLCnano System to the EASY-Spray Column

Follow the appropriate procedure for a one- or two-column setup. The two-column setup includes a precolumn connected across the autosampler valve.

Note To connect the RSLCnano system to the EASY-Spray column, you must use the Thermo Scientific Dionex UltiMate 3000 RSLCnano EASY-Spray Application Kit (P/N 6720.0395).

- To plumb a one-column setup from an RSLCnano instrument
- To plumb a two-column setup from an RSLCnano instrument (on page 30)

❖ To plumb a one-column setup from an RSLCnano instrument

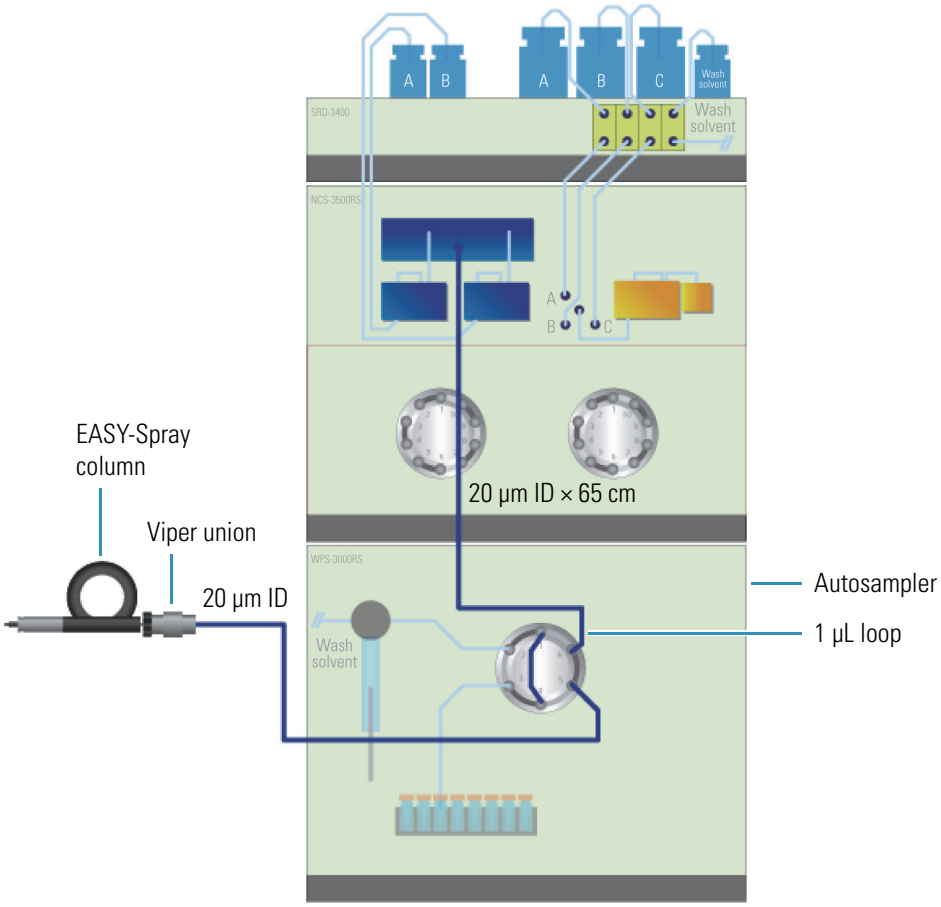
1. Insert the nanoViper fitting on the 20 µm ID nanoViper capillary into port 5 of the autosampler valve (Figure 22).
2. Insert the fitting on the other end of the capillary into the Viper union, tighten the fitting by hand until you feel resistance, and then tighten the fitting again by an additional 1/8- to 1/4-turn (45–90 degrees). Do not tighten the fitting by more than a 1/4-turn.

CAUTION Because the fittings seal against each other inside the union, do not tighten them by more than 1/4-turn (90 degrees). Overtightening the fittings can irreparably damage their sealing surfaces.

For additional information about nanoViper fittings, see "Using the nanoViper Fitting" on page 22.

3. Connect the union to the EASY-Spray column to complete the one-column setup (Figure 22).

Figure 22. Example of a one-column setup for the RSLCnano system (direct injection)



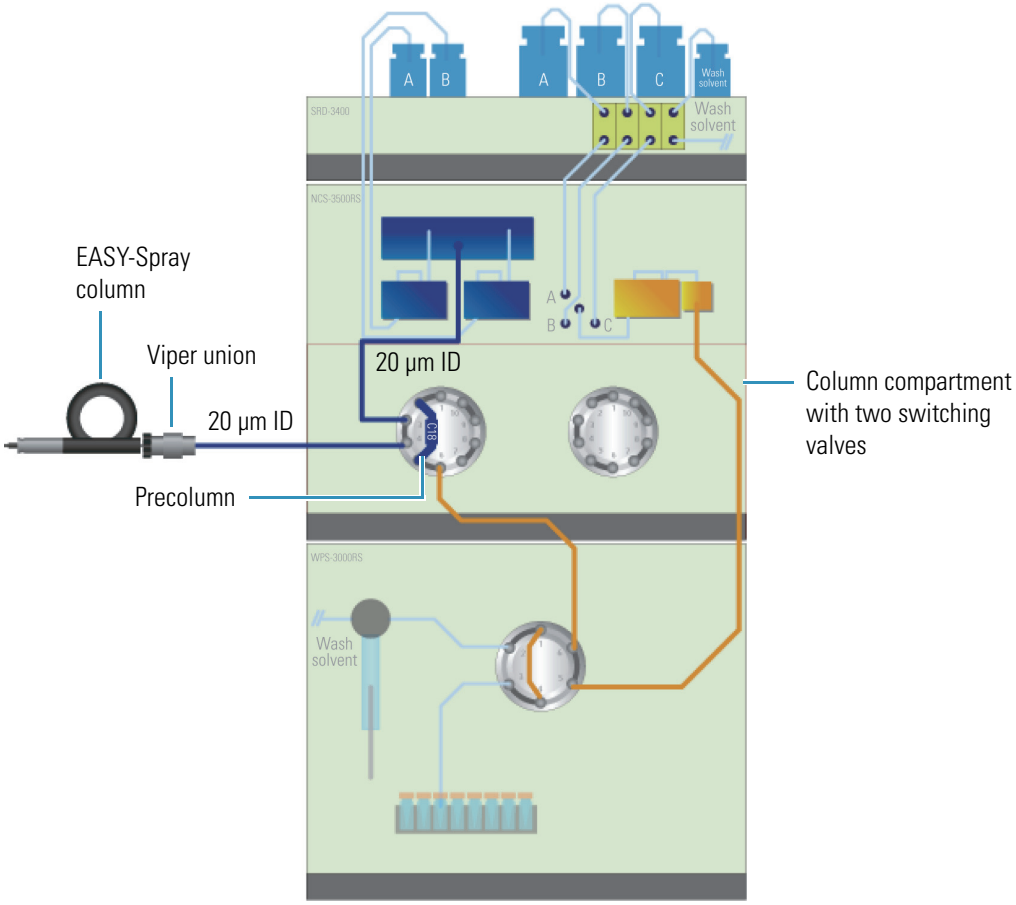
❖ To plumb a two-column setup from an RSLCnano instrument

1. Connect the precolumn to ports 2 and 5 on one of the switching valves (Figure 23).
2. Insert the nanoViper fitting on the 20 µm ID nanoViper capillary into port 4 on the same switching valve.
3. Insert the fitting on the other end of the capillary into the Viper union, tighten the fitting by hand until you feel resistance, and then tighten the fitting again by an additional 1/8- to 1/4-turn (45–90 degrees). Do not tighten the fitting by more than a 1/4-turn.

   Note See the caution statement on page 28.

4. Connect the union to the EASY-Spray column to complete the two-column setup (Figure 23).

Figure 23. Example of a two-column setup for the RSLCnano system (preconcentration)



Configuring the Mass Spectrometer for NSI Mode

Follow the applicable procedures to configure the Thermo Scientific mass spectrometer for nanoelectrospray ionization (nanoESI or NSI) mode.

Contents

- Selecting Nanospray as the Ion Source
- Configuring the nanoESI (NSI) Source Parameters

Selecting Nanospray as the Ion Source

Note This section is for the LCQ Deca XP Max mass spectrometer, which uses the Thermo Xcalibur™ data system version 2.0.7 or earlier.

After you install the EASY-Spray source, use the Instrument Configuration window to configure the mass spectrometer for NSI mode.

❖ To configure the mass spectrometer for NSI mode

1. If open, close the Xcalibur data system and Tune Plus application.
2. On the Microsoft™ Windows™ taskbar, choose **Start > All Programs > Xcalibur > Instrument Configuration** to open the Instrument Configuration window.
3. Select the devices to control from the Xcalibur data system if not already selected:
   a. In the Device Types list, select **All**.
   b. Under Available Devices, double-click the icons for the mass spectrometer and nanoelectrospray LC instrument to add them to the Configured Devices list.
4. Double-click the mass spectrometer icon to open the *Model* Configuration dialog box.
5. In the left pane, select **Ion Source** to display the ion source configuration page, and then select **Nanospray** in the Default Source list.
6. Click **OK**, and then click **OK** again to close the message box.
7. Configure the LC device if you have not done so.

   For instructions, refer to the LC instrument documentation.

8. In the Instrument Configuration window, click **Done**.
9. Restart the data system computer and the mass spectrometer.

Configuring the nanoESI (NSI) Source Parameters

After you complete the instrument configuration, use the Tune Plus application to configure the NSI source parameters in the NSI Source dialog box.

❖ To set the NSI source parameters

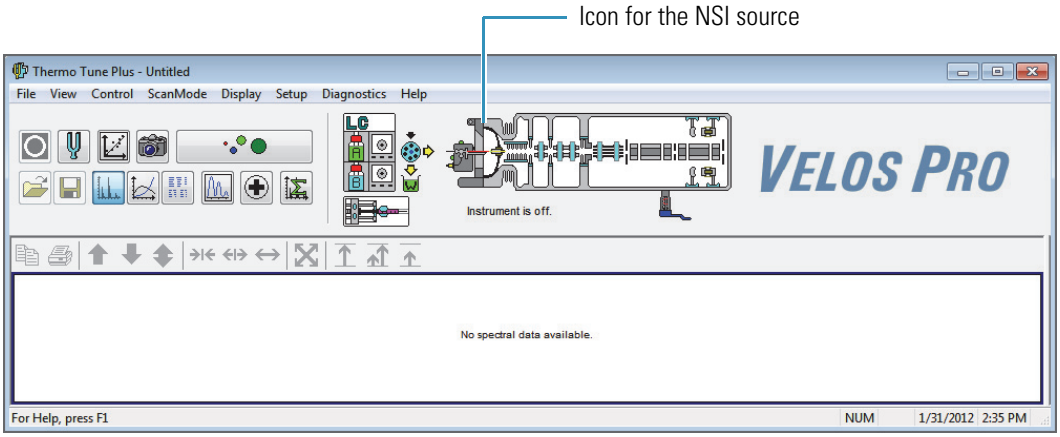
1. Do one of the following to open the Tune Plus window (Figure 24):

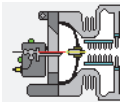
   - On the Windows taskbar, choose **Start > All Programs > Thermo Instruments > *model* > *model* Tune**, where *model* is your specific mass spectrometer.
   - In the Xcalibur application, click the **Roadmap View** icon, the **Instrument Setup** icon, the ***model* MS** icon, and then **Tune Plus**.

     –or–

   - In the Xcalibur application, click the **Roadmap View** icon, the **Instrument Setup** icon, and the ***model* MS** icon. Then, from the main toolbar choose ***model* > Start Tune Plus**.

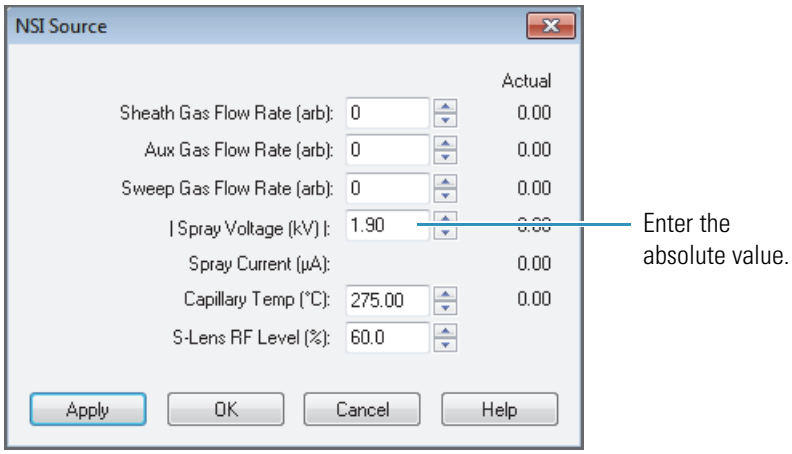
Figure 24. Tune Plus window for an NSI-configured Velos Pro (example)





2. Click the **NSI Source** icon (or choose **Setup > NSI Source**) to open the NSI Source dialog box (Figure 25).

Figure 25. NSI Source dialog box



3. In the |Spray Voltage (kV)| box, enter **1.90**.

   Use 1.90 kV as the start value for the spray voltage. If the intensity of the full-scan spectrum is low, gradually increase the spray voltage to improve the spectrum. The recommended range for the spray voltage is 1.40–2.40 kV.

4. Click **OK**.

Maintenance

This chapter describes how to replace the controller PCB in the EASY-Spray source.

For optimal results, follow these guidelines when performing the procedure in this chapter:

- Take precautions against electrostatic discharge (ESD), especially when the lab environment is at the lower end of the relative humidity specification (see page xii). For additional guidelines, refer to the "Operating Environment" chapter in the preinstallation requirements guide for your mass spectrometer.
- Proceed methodically.
- Always place the components on a clean, lint-free surface.
- Never overtighten a screw or use excessive force.

Contents

- Tools and Supplies
- Replacing the Controller PCB

Tools and Supplies

Table 6 lists the required tools and supplies for the maintenance of the EASY-Spray source.

Table 6. Tools and supplies

Description	Part number
Controller PCB and 2.5 mm hex key	ES230

Replacing the Controller PCB

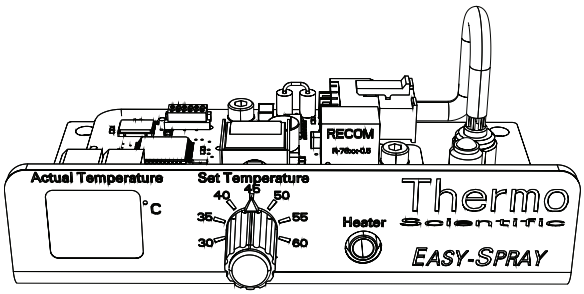
If the controller PCB becomes damaged, the actual temperature display might remain off and the EASY-Spray column might not heat. Follow this procedure to install a new controller PCB.

❖ To replace the controller PCB

1. Follow the procedure "To remove the source from the mass spectrometer" on page 14.
2. Using the 2.5 mm hex key, remove the four hex socket-head screws located on the bottom of the source (Figure 12 on page 13).
3. Slowly pull out the enclosure for the controller PCB (Figure 26).

IMPORTANT If you remove the controller PCB too quickly or at an angle, you might damage the PCB components or the internal heater cable routed above the controller PCB.

Figure 26. Controller PCB removed from the EASY-Spray source

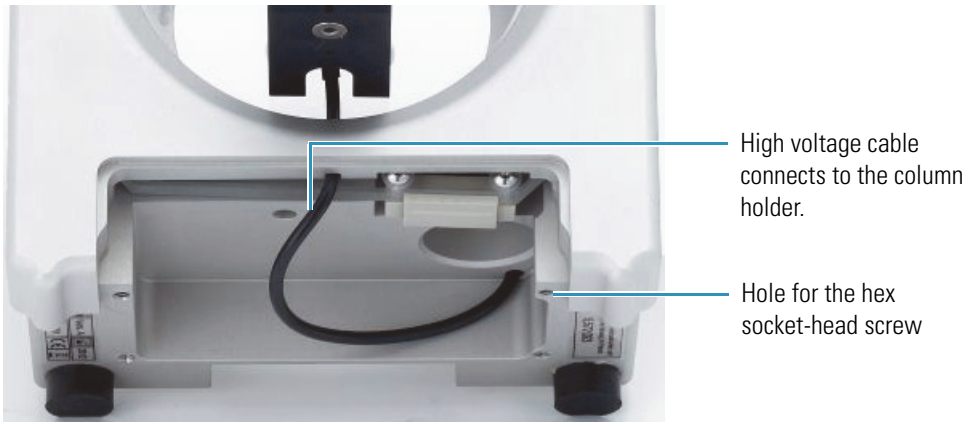


4. Unpack the new controller PCB and make sure it is not damaged.

CAUTION To prevent damage to the electronic components on the PCB due to ESD, hold the new controller unit by the metal enclosure instead of the PCB.

5. Slowly push the new controller PCB enclosure into place, and route the heater cable so that it does not become damaged (pinched) (Figure 27).

Figure 27. Bottom of the EASY-Spray source without the controller PCB



6. Using the 2.5 mm hex key, install the four hex socket-head screws into the bottom of the controller PCB enclosure.

You can now install the EASY-Spray source back onto the mass spectrometer. To dispose of the old controller PCB, see "WEEE Compliance" on page ix.

Troubleshooting

Table 7 lists some EASY-Spray source and column problems, their causes, and their possible solutions. You can resolve most problems by using a new EASY-Spray column.

If you need further troubleshooting assistance, contact your local Thermo Fisher Scientific field service engineer. See "Contacting Us" on page xv.

Table 7. EASY-Spray source problems, causes, and solutions (Sheet 1 of 2)

Problem	Cause	Solution
The spray is unstable.	There is a leak somewhere in the liquid path.	Check all of the LC connections.
	Air bubbles in the emitter might cause the spray to "spit."	Try degassing the mobile phase or purging the line, and then recheck the line for air bubbles.
	The EASY-Spray column is out of alignment.	Follow the procedure "Adjusting the Emitter Tip Position" on page 11.
	The source high-voltage (HV) connection might be unstable.	Check the high voltage contact on the back of the EASY-Spray source (Figure 7 on page 9) and the front of the mass spectrometer. If the problem continues, do the following: 1. Open Tune Plus, choose **View > Display Status View**, and then click the **All** tab. 2. Choose **Setup > NSI Source** to open the NSI Source dialog box. 3. Compare the setting in the NSI Source dialog box to the readback value for the NSI source's absolute spray voltage. A green check mark (✓ Spray Voltage (kV):) indicates that the parameter is functioning properly.
	There is an emitter blockage from particles in the sample, other small particles from the flow lines or valves, and so on.	Try adjusting the spray voltage. If that does not resolve the blockage problem, insert a new EASY-Spray column.

Table 7. EASY-Spray source problems, causes, and solutions (Sheet 2 of 2)

Problem	Cause	Solution
The signal intensity is weak.	The parameters for the LC, MS, or both might need adjusting.	Try these solutions: • Verify that the EASY-Spray column is correctly positioned (that is, clicks on insertion). • Check the LC method and MS tune method parameters. • Run a known standard to check the sensitivity.
	The mass spectrometer's spray cone and ion transfer tube are dirty.	Clean both the spray cone and ion transfer tube. For instructions, refer to the mass spectrometer's documentation.
Heater issues: The column is not heated. –or– The actual temperature display is blank.	The heater is off, or there might be a loose connection or a damaged PCB.	Try these solutions: • Turn on the heater by selecting a temperature setting. • Check all of the connections for the controller power supply unit from the electrical wall outlet to the EASY-Spray source. • See "Replacing the Controller PCB" on page 36.
	The EASY-Spray column is damaged.	Replace the EASY-Spray column.

Replaceable Parts

This chapter lists the consumable and replaceable parts for the EASY-Spray source, and their corresponding part numbers. To order any of these parts, contact your local Thermo Fisher Scientific field service engineer or go to www.proxeon.com/easyspray.

Contents

- Spare Parts
- Consumables

Spare Parts

A/B mixing/venting tee	SC901
EASY-Spray controller PCB (with a 2.5 mm hex key)	ES230
EASY-Spray controller power supply with power adapter cable	ES231
EASY-Spray tools: emitter positioning tool and hex keys (1.5 mm and 3 mm)	ES232
Monitor and power supply unit	ES217
Video camera and power supply unit	ES216

Consumables

EASY-Spray column, 15 cm × 75 µm ID, PepMap™ C18, 3 µm particles	ES800
EASY-Spray column, 15 cm × 50 µm ID, PepMap RSLC C18, 2 µm particles	ES801
EASY-Spray column, 25 cm × 75 µm ID, PepMap RSLC C18, 2 µm particles	ES802
EASY-Spray column, 50 cm × 75 µm ID, PepMap RSLC C18, 2 µm particles	ES803

Glossary

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A

API ion transfer tube A tube assembly that assists in desolvating ions that are produced by the ESI, nanoESI (NSI), or APCI probe.

atmospheric pressure chemical ionization (APCI) A soft ionization technique done in an ion source operating at atmospheric pressure. Electrons from a corona discharge initiate the process by ionizing the mobile phase vapor molecules. A reagent gas forms, which efficiently produces positive and negative ions of the analyte through a complex series of chemical reactions.

atmospheric pressure ionization (API) Ionization performed at atmospheric pressure by using atmospheric pressure chemical ionization (APCI), electrospray ionization (ESI), or nanoelectrospray ionization (nanoESI or NSI).

D

dynamic nanoelectrospray *See* nanoESI nanoLC gradient separation.

E

electrospray ionization (ESI) A type of atmospheric pressure ionization that is currently the softest ionization technique available to transform ions in solution into ions in the gas phase.

H

H-ESI Heated-electrospray ionization (H-ESI), a type of atmospheric pressure ionization, converts ions in solution into ions in the gas phase by using electrospray ionization (ESI) in combination with heated auxiliary gas.

I

ion source A device that converts samples to gas-phase ions.

ion sweep cone A removable cone-shaped metal cover that fits on top of the API ion transfer tube and acts as a physical barrier to protect the entrance of the tube.

N

nano liquid chromatography (nanoLC) Liquid chromatography with typical flow rates of 10–1000 nL/min and 10–150 µm diameter columns.

nanoelectrospray ionization (nanoESI or NSI) A type of electrospray ionization (ESI) that accommodates very low flow rates of sample and solvent on the order of 1–20 nL/min (for static nanoelectrospray) or 100–1000 nL/min (for dynamic nanoelectrospray, which is also called nanoESI nanoLC gradient separation).

nanoESI nanoLC gradient separation Employs microscale capillary columns to separate the analytes in complex mixtures. The sample is loaded onto a column using an injection valve or a gas pressure vessel. The mixture components are then eluted by a solvent gradient and pumped through the emitter.

nanoESI (NSI) source The entire nanoelectrospray ion source.

nanoESI (NSI) spray current The flow of charged particles in the nanoESI (NSI) source. The voltage on the NSI spray needle supplies the potential required to ionize the particles.

nanoESI (NSI) spray voltage The high voltage that is applied to the spray needle in the nanoESI (NSI) source to produce the NSI spray current as liquid emerges from the nozzle. The NSI spray voltage is selected and set; the NSI spray current varies.

nanospray ionization (NSI) *See* nanoelectrospray ionization (nanoESI or NSI).

S

source *See* ion source.

static nanoelectrospray A device that performs continuous analysis of small analyte solution volumes over an extended period of time.

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